Heart Failure for the Primary Care Provider

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Heart Failure

“Two of the scariest words in the English language.”
Objectives

- Review Heart Failure (HF) statistics and the impact on health care costs
- Briefly review the data supporting evidence based delivery of care
- Define CORE Measures: TJC criteria for “grading” in hospital HF care
- Discuss heart failure management: from ACE inhibitor to device therapy
Heart Failure Epidemic

- 5.7 million Americans are currently living with heart failure
- 670,000 new cases diagnosed each year
- With aging of the baby boomers:
  - Growing epidemic
  - Rising healthcare costs
CHF Epidemic

- Major public health problem resulting in substantial morbidity and mortality
  (76% men & 69% women die within 5 years)
- Despite advances, outcomes data suggests a substantial number of patients are not receiving optimal care

<table>
<thead>
<tr>
<th>Population Group</th>
<th>Prevalence</th>
<th>Incidence</th>
<th>Mortality</th>
<th>Hospital Discharges</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total population</td>
<td>5,700,000</td>
<td>670,000</td>
<td>277,193</td>
<td>990,000</td>
<td>$39.2 billion</td>
</tr>
</tbody>
</table>

Estimated Direct and Indirect Costs of HF in US

Total Cost
$39.2 billion

Hospitalization $20.9 (53.3%)
Lost Productivity/Mortality* $4.1 (10.5%)
Home Healthcare $3.8 (9.7%)
Drugs/Other Medical Durables $3.2 (8.2%)
Nursing Home $4.7 (11.9%)
Physicians/Other Professionals $2.5 (6.4%)

Heart Failure Hospitalizations

1.0 Million Hospitalizations a Year and Rising

The majority of patients hospitalized with HF were previously hospitalized with HF

United States: 1979-2006 Source: NHDS/NCHS, NHLBI. Hospital Compare 2007-2010

30-Day Rehospitalization Rates in HF
24.8% (Medicare)
Evidence Based, Guidelines Driven Heart Failure Care

- Improves outcomes
- Reduces healthcare expenditures
- Increases hospital and physician reimbursement
- Avoids financial penalties
Improved Adherence to ACC/AHA HF Guidelines Translates to Improved Clinical Outcomes

- Each 10% improvement in ACC/AHA guideline-recommended composite care is associated with a 13% lower mortality rate at 24 months p<0.0001.

# Established Benefits of Guideline-Recommended HF Therapies

<table>
<thead>
<tr>
<th>Guideline Recommended Therapy</th>
<th>Relative Risk Reduction in Mortality</th>
<th>Number Needed to Treat for Mortality</th>
<th>NNT for Mortality (standardized to 36 months)</th>
<th>Relative Risk Reduction in HF Hospitalizations</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACEI/ARB</td>
<td>17%</td>
<td>22 over 42 months</td>
<td>26</td>
<td>31%</td>
</tr>
<tr>
<td>Beta-blocker</td>
<td>34%</td>
<td>28 over 12 months</td>
<td>9</td>
<td>41%</td>
</tr>
<tr>
<td>Aldosterone Antagonist</td>
<td>30%</td>
<td>9 over 24 months</td>
<td>6</td>
<td>35%</td>
</tr>
<tr>
<td>Hydralazine/Nitrate</td>
<td>43%</td>
<td>25 over 10 months</td>
<td>7</td>
<td>33%</td>
</tr>
<tr>
<td>CRT</td>
<td>36%</td>
<td>12 over 24 months</td>
<td>8</td>
<td>52%</td>
</tr>
<tr>
<td>ICD</td>
<td>23%</td>
<td>14 over 60 months</td>
<td>23</td>
<td>NA</td>
</tr>
</tbody>
</table>

Core Measures

- Documentation of LV Systolic Function
- ACE or ARB (if EF<40%)
- Complete Discharge Instructions
- Other
  - Beta Blocker
  - ICD/CRT
  - Smoking Cessation
Complete Discharge Instructions

- 6 items that must be addressed:
  - Activity level
  - Diet instructions
  - Follow-up care
  - Home medications
  - Teaching on daily weight monitoring
  - Instruction regarding recognition of symptoms and what to do when they occur
Penalties for 30 Day Readmission Rate

- Hospitals with a high 30-day readmission rate will experience a reduction in reimbursement
  
  - Maximum of 1% starting in October 2012
  - Maximum of 2% in 2013
  - Maximum of 3% by 2014
Causes of Hospital Readmission for Heart Failure

Over 2/3 of HF Hospitalizations Preventable

- Diet Noncompliance: 24%
- Inappropriate Rx: 16%
- Noncompliance: 24%
- Failure to Seek Care: 19%
- Other: 17%

Annals of Internal Medicine 122:415-21, 1995
All-Cause Mortality After Each Subsequent Hospitalization for HF

<table>
<thead>
<tr>
<th>Hospitalization</th>
<th>Number of Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st admission</td>
<td>14,374</td>
</tr>
<tr>
<td>2nd admission</td>
<td>3,358</td>
</tr>
<tr>
<td>3rd admission</td>
<td>1,123</td>
</tr>
<tr>
<td>4th admission</td>
<td>417</td>
</tr>
</tbody>
</table>

1st hospitalization: 30-day mortality = 12%; 1-year mortality = 34%

Management of Heart Failure

Overview

Primary aims of therapy

- Improve symptoms and quality of life
  - Relieve circulatory congestion
  - Increase tissue perfusion
- Prolong life by slowing disease progression
  - Reduce vasoconstriction
  - Inhibit activation of the renin-angiotensin-aldosterone system and the sympathetic nervous system
  - Inhibit progressive enlargement or remodeling of the left ventricle
Clinical Evaluation

- Evaluate for myocardial ischemia during the initial assessment
- Evaluate for precipitating causes
Common Factors That Precipitate Hospitalization for Heart Failure

- Noncompliance with medical regimen, sodium and/or fluid restriction
- Acute myocardial ischemia
- Uncorrected high blood pressure
- Atrial fibrillation and other arrhythmias
- Recent addition of negative inotropic drugs (verapamil, nifedipine, diltiazem, beta blockers)
- Pulmonary embolus
- Nonsteroidal anti-inflammatory drugs
- Excessive alcohol or illicit drug use
- Endocrine abnormalities (diabetes mellitus, thyroid dysfunction)
- Concurrent infections (pneumonia, viral illness)
Clinical Evaluation

Features that increase the likelihood of heart failure
- Paroxysmal nocturnal dyspnea (2-fold increase)
- Presence of an S₃ (11-fold increase)

Features that decrease the likelihood of heart failure
- Absence of dyspnea on exertion (50% decrease)
- Absence of crackles on pulmonary auscultation (50% decrease)

*Predictability of the clinical exam: diminishes significantly in chronic or gradually developing HF
Diagnostic Testing

Echocardiography –

- An essential part of the initial evaluation
- Necessary for distinguishing systolic heart failure from heart failure with preserved systolic function
- Reassessment most useful when there is a change in clinical status (not at regular or arbitrary intervals)
Heart Failure with Preserved Systolic Function

- Diagnosed when signs and symptoms of heart failure are present
- Normal LV ejection fraction by echo
- Absence of valvular or pericardial abnormalities that would explain symptoms
- Approximately 50% of HF patients have preserved systolic function
<table>
<thead>
<tr>
<th>Table 6. Differential Diagnosis in a Patient with Heart Failure and Normal Left Ventricular Ejection Fraction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Incorrect diagnosis of HF</td>
</tr>
<tr>
<td>Inaccurate measurement of LVEF</td>
</tr>
<tr>
<td>Primary valvular disease</td>
</tr>
<tr>
<td>Restrictive (infiltrative) cardiomyopathies</td>
</tr>
<tr>
<td>Amyloidosis, sarcoidosis, hemochromatosis</td>
</tr>
<tr>
<td>Pericardial constrictive</td>
</tr>
<tr>
<td>Episodic or reversible LV systolic dysfunction</td>
</tr>
<tr>
<td>Severe hypertension, myocardial ischemia</td>
</tr>
<tr>
<td>HF associated with high metabolic demand</td>
</tr>
<tr>
<td>Anemia, thyrotoxicosis, arteriovenous fistulae</td>
</tr>
<tr>
<td>Chronic pulmonary disease with right HF</td>
</tr>
<tr>
<td>Pulmonary hypertension associated with pulmonary vascular disorders</td>
</tr>
<tr>
<td>Atrial myxoma</td>
</tr>
<tr>
<td>Diastolic dysfunction of uncertain origin</td>
</tr>
<tr>
<td>Obesity</td>
</tr>
</tbody>
</table>

HF = heart failure; LVEF = left ventricular ejection fraction; LV = left ventricular.
Diagnostic Testing

Electrocardiogram

- Evidence of prior MI
- Atrial enlargement
- Ventricular hypertrophy
- Arrhythmia or conduction abnormalities
Diagnostic Testing

Laboratory Evaluation

- Electrolytes
- Renal function
- Hepatic function
- Blood counts
- Thyroid function
- BNP
Diagnostic Testing

BNP

- BNP <100 pg/ml in a patient with acute dyspnea makes acute HF unlikely
- Not a reliable measure of severity of chronic heart failure
- Use caution when interpreting BNP levels outside the acute setting
- Patients with chronic HF can have very low BNP levels
<table>
<thead>
<tr>
<th>ACC/AHA Stage</th>
<th>NYHA Functional Class</th>
<th>Estimated 1-Year Mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>—</td>
<td>See note</td>
</tr>
<tr>
<td>B</td>
<td>I</td>
<td>5%–10%</td>
</tr>
<tr>
<td></td>
<td>Asymptomatic</td>
<td>5%–10%</td>
</tr>
<tr>
<td>C</td>
<td>II</td>
<td>15%–30%</td>
</tr>
<tr>
<td></td>
<td>Symptomatic; slight limitation of physical activity</td>
<td>15%–30%</td>
</tr>
<tr>
<td></td>
<td>III&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Symptomatic; marked limitation of physical activity</td>
<td>15%–30%</td>
</tr>
<tr>
<td>D</td>
<td>III&lt;sup&gt;a&lt;/sup&gt;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Symptomatic; marked limitation of physical activity</td>
<td>15%–30%</td>
</tr>
<tr>
<td></td>
<td>IV</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Inability to perform any physical activity without symptoms</td>
<td>50%–60%</td>
</tr>
</tbody>
</table>
Table 12. Medical Therapy for Systolic Heart Failure by Functional Status

<table>
<thead>
<tr>
<th>Class</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>All NYHA classes (I-IV):</td>
<td>ACE inhibitor (if ACE inhibitor is not tolerated because of cough, an ARB can be used; if ACE inhibitor is contraindicated because of hyperkalemia or renal insufficiency, hydralazine/isosorbide dinitrate can be used)</td>
</tr>
<tr>
<td></td>
<td>β-Blocker</td>
</tr>
<tr>
<td>NYHA class I-II (asymptomatic or mild symptoms):</td>
<td>Diuretic as needed to maintain euvolemia</td>
</tr>
<tr>
<td>NYHA class III-IV (moderate to severe symptoms):</td>
<td>Spironolactone (if bothersome side effect of gynecomastia occurs, eplerenone can be used)</td>
</tr>
<tr>
<td></td>
<td>For black patients, hydralazine/isosorbide dinitrate</td>
</tr>
<tr>
<td></td>
<td>Digoxin</td>
</tr>
<tr>
<td></td>
<td>Diuretic as needed to maintain euvolemia</td>
</tr>
</tbody>
</table>
Medical Therapy

ACE/ARB

- All NYHA functional class systolic HF including asymptomatic (Class I) patients
- Reduces mortality and morbidity in asymptomatic as well as symptomatic patients
- Delays the onset of clinical heart failure in asymptomatic patients
- Decreases overall mortality by 20%
- Decreases MI by 20%
- Reduces hospitalization for HF by 30-40%
ACE/ARB

- Ace inhibitors increase bradykinin, development of an Ace cough occurs in 10% patients
- Ace preferred over ARB as first choice
- Primary reason to select an ARB is the development of an Ace cough
- Lower incidence of Hyperkalemia with an ARB
- No difference in incidence of renal insufficiency between ACE and ARB
Medical Therapy

ACE/ARB

- Angioedema a rare but life threatening side effect
- If angioedema occurs avoid both Ace and ARB
- Combined treatment not recommended, offers no proven benefit
- Adverse effects of combination therapy: worsening renal function and symptomatic hypotension
Medical Therapy

ACE/ARB

- Avoid initiation of vasodilators in the setting of hypovolemia (ACE/ARB/Hydralazine)
- Hydralazine/isosorbide dinitrate combination: a suitable alternative in the setting of acute renal failure or hyperkalemia
- Benefit of high versus low dose Ace is minor (potentially fewer hospitalizations but no survival benefit)
- Follow up blood work: Potassium and creatinine levels 1-2 weeks post initiation
- Abrupt withdrawal should be avoided
Medical Therapy

β-Blockers

- All NYHA functional class systolic HF including asymptomatic (Class I) and severe (Class IV) patients
- 30% reduction in overall mortality
- Reduction in sudden death
- Reduction in death due to pump failure
Medical Therapy

β-Blockers indicated for HF

- Extended release metoprolol
  (succinate not tartrate)
- Carvedilol
- Bisoprolol
- No head to head study between Metoprolol ER and Carvedilol
Medical Therapy

β-Blockers

- Don’t initiate if acutely decompensated (hypotensive or volume overloaded)
- Results in a transient decline in cardiac output
- Initiate once euvolemic or near-euvolemic (often just prior to discharge)
- Large trials excluded patients with B/P<85 mmHg
β-Blockers

Adverse effects

- <1% incidence of significant fatigue generally resolves in 1-2 weeks
- Hypotension, usually asymptomatic, manifests in 24-48 hours after first dose or with an increase in dosage
- Exacerbation of bronchospastic pulmonary disease: low except in patients with refractory pulmonary disease
- In reactive airway disease, choose the more β₁ cardioselective agent (metoprolol succinate)
Initiating Ace and $\beta$-Blockers

Factors determining Ace, $\beta$-Blocker or both

- Blood pressure
- Creatinine
- Potassium
- Contraindications to either drug
Initiating Ace and $\beta$-Blockers

- If euvoletic, with an acceptable BP and without an elevated creatinine or potassium, both can likely be tolerated.
- Unless arrhythmia or acute renal injury, begin with Ace, add $\beta$-Blocker.
- More beneficial to add $\beta$-Blocker than to try to maximize the Ace.
- Minimize risk of hypotension by staggering the timing of $\beta$-Blocker and Ace dosing.
Medical Therapy

Diuretics

- Used for the management of volume overload
- Typically needed to achieve euvolemia and on a long term basis to prevent recurrence
- Spironolactone only diuretic shown to improve survival in NYHA Class III or IV patients
- Spironolactone at doses for HF is a weak diuretic
- Loop diurectics are used for volume overload because of their superior natriuretic effect (furosemide, bumetanide and torsemide)
Diuretics

Management of Diuretic Resistance

- Restriction of fluid <2L/dy
- Sodium restriction <2000 mg/dy
- If gut edema, change to a diuretic with enhanced bioavailability (bumetanide or torsemide)
- Change route of administration
- Change timing of administration
- Use of diuretic combinations
  (Loop Diuretic + HCTZ or Metalazone)
- Consider continuous infusion if maximum intermittent IV dosing is ineffective
Medical Therapy

Digoxin

- Role primarily for symptom control in NYHA Class III or IV patients
- No mortality benefit
- Shown to reduce hospitalizations
- Lower serum concentrations as effective as higher levels
- Digoxin levels ≥1.2 ng/ml associated with higher mortality
Medical Therapy

Spironolactone

- Recommended in addition to Ace and β-Blocker in NYHA Class III or IV patients
- RALES trial demonstrated 30% reduction in mortality and 35% reduction in hospitalizations
Spironolactone

Risk factors for Hyperkalemia

- Impaired renal function (creatinine $\geq 1.6$ mg/dl or GFR $< 30$ ml/min)
- Concurrent use of higher doses of ACE (≥10mg of Enalapril or Lisinopril)
- Potassium $\geq 5.0$ mEq/L
- Concomitant use of NSAIDs
- Potassium supplementation
Spironolactone

Potassium monitoring

- 3 days after initiation
- 1 week
- Q monthly for a minimum of 3 months
Medical Therapy

Eplerenone

• 15% reduction in mortality among patients with LV dysfunction after an acute MI
• Can be used in place of Spironolactone if gynecomastia develops
Table 13. Oral Medications Commonly Used for Treatment of Heart Failure

<table>
<thead>
<tr>
<th>Drug</th>
<th>Initial Dose</th>
<th>Maximum Dose</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ACE inhibitors</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Captopril</td>
<td>6.25 mg TID</td>
<td>50 mg TID</td>
</tr>
<tr>
<td>Enalapril</td>
<td>2.5 mg BID</td>
<td>10-20 mg BID</td>
</tr>
<tr>
<td>Fosinopril</td>
<td>5-10 mg once daily</td>
<td>40 mg once daily</td>
</tr>
<tr>
<td>Lisinopril</td>
<td>2.5-5.0 mg once daily</td>
<td>20-40 mg once daily</td>
</tr>
<tr>
<td>Quinapril</td>
<td>5 mg BID</td>
<td>20 mg BID</td>
</tr>
<tr>
<td>Ramipril</td>
<td>1.25-2.5 mg once daily</td>
<td>10 mg once daily</td>
</tr>
<tr>
<td>Trandolapril</td>
<td>1 mg once daily</td>
<td>4 mg once daily</td>
</tr>
<tr>
<td><strong>ARBs</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Candesartan</td>
<td>4-8 mg once daily</td>
<td>32 mg once daily</td>
</tr>
<tr>
<td>Losartan&lt;sup&gt;a&lt;/sup&gt;</td>
<td>25-50 mg once daily (may divide dose to twice daily)</td>
<td>50-100 mg once daily</td>
</tr>
<tr>
<td>Valsartan</td>
<td>20-40 mg BID</td>
<td>160 mg BID</td>
</tr>
<tr>
<td><strong>β-Blockers</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bisoprolol&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1.25 mg once daily</td>
<td>10 mg once daily&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Carvedilol</td>
<td>3.125 mg BID</td>
<td>25 mg BID; 50 mg BID for &gt;85 kg&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td>Metoprolol succinate</td>
<td>12.5-25.0 mg daily</td>
<td>200 mg once daily&lt;sup&gt;b&lt;/sup&gt;</td>
</tr>
<tr>
<td><strong>Loop diuretics&lt;sup&gt;c&lt;/sup&gt;</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bumetanamide</td>
<td>0.5-1.0 mg once or twice daily</td>
<td>Up to 10 mg daily&lt;sup&gt;d&lt;/sup&gt;</td>
</tr>
<tr>
<td>Furosemide</td>
<td>20-40 mg once or twice daily</td>
<td>Up to 600 mg daily&lt;sup&gt;d&lt;/sup&gt;</td>
</tr>
<tr>
<td>Torsemide</td>
<td>10-20 mg once daily</td>
<td>Up to 200 mg daily&lt;sup&gt;d&lt;/sup&gt;</td>
</tr>
<tr>
<td>Digitalis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Digoxin</td>
<td>0.125-0.250 mg once daily</td>
<td>0.125-0.250 mg once daily</td>
</tr>
<tr>
<td><strong>Aldosterone antagonists</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spironolactone</td>
<td>12.5 to 25.0 mg once daily</td>
<td>50 mg once daily</td>
</tr>
<tr>
<td>Eplerenone</td>
<td>25 mg once daily</td>
<td>50 mg once daily</td>
</tr>
</tbody>
</table>

ACE = angiotensin-converting enzyme; ARB = angiotensin receptor blocker; BID = twice daily; TID = three times daily.

<sup>a</sup>Off-label use.
<sup>b</sup>Target dose.
<sup>c</sup>Thiazide diuretics are not listed but may be appropriate for patients with mild heart failure or associated hypertension or as a second diuretic in patients refractory to loop diuretics alone.
<sup>d</sup>Titrated to achieve dry weight.
Hydralazine & Isosorbide Dinitrate

AAHEFT (African American Heart Failure Trial)
- Blacks with severe heart failure (NYHA Class III or IV)
- 40% reduction in mortality
- Added to standard therapy (Ace/ARB and β-Blocker)
- As with all vasodilators, need adequate B/P before initiation
- Generally tolerated in severe heart failure without hypotension because vasodilation increases cardiac output
Table 12. Medical Therapy for Systolic Heart Failure by Functional Status

Initial Therapy

**All NYHA classes (I-IV):**
ACE inhibitor (if ACE inhibitor is not tolerated because of cough, an ARB can be used; if ACE inhibitor is contraindicated because of hyperkalemia or renal insufficiency, hydralazine/isosorbide dinitrate can be used)

β-Blocker

Additional Therapy

**NYHA class I-II (asymptomatic or mild symptoms):**
Diuretic as needed to maintain euvolemia

**NYHA class III-IV (moderate to severe symptoms):**
Spironolactone (if bothersome side effect of gynecomastia occurs, eplerenone can be used)
For black patients, hydralazine/isosorbide dinitrate

Digoxin

Diuretic as needed to maintain euvolemia
Calcium Channel Blockers

- First generation increases the risk of acute decompensation and hospitalization (nifedipine, verapamil)
- Second generation without added risk
- Used for management of hypertension and angina
- Amlidopine and Felodipine only calcium channel blockers with neutral effects on mortality in heart failure trials
Device Therapy

(AICD) Implantable Cardioverter – Defibrillator

- Improves survival in appropriate candidates
- Inadequate data to guide use in NYHA Class I or NYHA Class IV patients
Device Therapy

Cardiac Resynchronization Therapy (CRT)

- Intraventricular conduction delay (LBBB) results in poor coordination of ventricular contraction
- 1 pulse generator can provide support for both biventricular pacing and ICD discharge
Device Therapy

CRT

- Improves quality of life
- Reduces symptoms
- 37% reduction in hospitalizations
- 22% reduction in all cause mortality
- 30% of patients meeting criteria have no improvement
- Improvement in eligibility criteria is needed
Evidence-Based Treatment for Heart Failure with Reduced LVEF

Reduce Mortality
- ACEI or ARB
- β-Blocker
- Aldosterone Antagonist

Control Volume
- Sodium Restriction*
- Diuretics*

Treat Residual Symptoms
- Digoxin*

Enhance Adherence
- CRT ± an ICD*
- Hyd/ISDN*
- Education
- Disease Management
- Performance Improvement Systems

Treat Comorbidities
- Aspirin*
- Warfarin*
- Statin*
Figure 1. Stages in the Development of Heart Failure/Recommended Therapy by Stage.

At Risk for Heart Failure

Stage A
At high risk for HF but without structural heart disease or symptoms of HF
- e.g., Patients with:
  - hypertension
  - atherosclerotic disease
  - diabetes
  - obesity
  - metabolic syndrome
- or Patients:
  - using cardiotoxic
  - with FHC CM

Stage B
Structural heart disease but without signs or symptoms of HF
- e.g., Patients with:
  - previous MI
  - LV remodeling including LVH and low EF
  - asymptomatic valvular disease

Stage C
Structural heart disease with prior or current symptoms of HF
- e.g., Patients with:
  - known structural heart disease
  - shortness of breath and fatigue, reduced exercise tolerance

Stage D
Refractory HF requiring specialized interventions
- e.g., Patients who have marked symptoms at rest despite maximal medical therapy (e.g., those who are recurrently hospitalized or cannot be safely discharged from the hospital without specialized interventions)

Goals
- Treat hypertension
- Encourage smoking cessation
- Treat lipid disorders
- Encourage regular exercise
- Discourage alcohol intake, illicit drug use
- Control metabolic syndrome

Drugs
- ACEI or ARB in appropriate patients (see full-text guideline) for vascular disease or diabetes

Devices in Selected Patients
- Implantable defibrillators

Goals
- All measures under Stage A
- Dietary salt restriction

Drugs for Routine Use
- Diuretics for fluid retention
- ACEI
- Beta-blockers

Drugs in Selected Patients
- Aldosterone antagonist
- ARBs
- Digitalis
- Hydralazine/nitrates

Devices in Selected Patients
- Biventricular pacing
- Implantable defibrillators

Goals
- Appropriate measures under Stages A, B, C
- Decision re: appropriate level of care

Options
- Compassionate end-of-life care/hospice
- Extraordinary measures
  - heart transplant
  - chronic inotropes
  - permanent mechanical support
  - experimental surgery or drugs

HF = heart failure; MI = myocardial infarction; LV = left ventricular; LVH = left ventricular hypertrophy; EF = ejection fraction; FHC CM = family history of cardiomyopathy; ACEI = angiotensin converting enzyme inhibitor; ARB = angiotensin receptor blocker.